PATENT SPECIFICATION

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DRAWINGS ATTACHED

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(54) ROTARY SHAFT SEAL

(71) We, V. GALLINO & C., S.p.A., an Italian Company, of 178 Via Torino, Regina Margherita, Turin, Italy, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to seals for rotary shafts.

More particularly, the invention concerns rotating shaft seals of the type formed by a rigid cover, preferably of metal, adapted to be force-fitted into a seat in a support surrounding a rotary shaft and an annular resilient lip, which makes circumferential contact with the surface of the shaft and is pressed against the shaft by a garter spring.

In seals of this known type the resilient lip has a cross-sectional profile with a sharp edge which makes contact with the surface of the rotating shaft. It is, therefore, necessary when assembling the seal that this lip remains intact and does not undergo any deterioration, since the efficacy of the seal depends mainly on the soundness of the said edge.

When mounting seals of the aforesaid type on fluted shafts, as for example half-shafts which connect the road wheels of a vehicle to the differential gear, it often happens that the fluted parts of the shafts, generally formed with splines having sharp edges, cause damage to the resilient lips of the associated seals, jeopardising the sealing action of the same. This disadvantage is due to the fact that during the assembly of the seal, the shaft cannot always be maintained in a constant angular position with respect to the resilient lip of the seal, and consequently every radial movement of the shaft relative to the lip, caused by eccentricity of the shaft relative to its support, is sufficient to cause damage.

The present invention aims at avoiding this disadvantage by providing a seal of the above-mentioned type, in which the annular resilient lip is efficiently protected against the damage caused by any eccentricity of the shaft relative to its support during the assembly of the seal.

A further object of this invention is to provide a seal of the above-mentioned type, which is of simple, strong and economical construction and of high operational efficiency.

The present invention accordingly provides a seal for a rotary shaft of the type comprising a rigid cover adapted to be force-fitted into a seat in a support surrounding a rotary shaft, an annular resilient lip mounted in the cover and adapted to make circumferential contact with the surface of the shaft, and an annular garter spring which presses the said lip against said shaft surface, in which the rigid cover is provided on at least one of its axial ends with a rigid annular flange having an inner diameter greater than the inner diameter of the said lip, so as to act as a support for the shaft in use of the seal in the event of eccentric or radial displacement of the shaft relative to its support, and for the purpose of avoiding excessive deformation of the lip during assembly of the seal, the annular flange having a rounded shape and being bent in a direction away from the lip.

The invention will now be described, by way of non-limiting example, with reference to the accompanying drawings, in which:—

Figure 1 is a schematic axial section of a seal for a rotating shaft according to one embodiment of the invention, illustrated in its assembled position, and

Figures 2 and 3 are partial axial sections on an enlarged scale of two seals according to two different variations of the embodiment of Figure 1.

The drawings show a seal according to this invention interposed between a rotary shaft 1 and a fixed support 2 in which the shaft 1 is supported. The seal is formed by a rigid cover 3, generally of metal, which in the illustrated example is formed by two co-operating sheet metal elements 3*a*, 3*b* of L-shaped cross-section, placed so as to form a box with a substantially U-shaped cross-section. In this box a resilient annular lip

5 is mounted which projects inwardly from a wall of the cover 3 and fits tightly around the shaft 1. The lip 5 is pressed against the surface of the shaft 1 by the action of a circumferentially continuous helical garter spring 6, in the shape of a ring, which surrounds the said lip 5.

One of the elements 3*b* forming the rigid cover 3 is provided with a rounded annular flange 7 which is obtained by bending outwardly an annular edge portion of the element 3*b* itself and which serves to protect the lip 5. The flange 7 has an internal diameter slightly greater than the internal diameter of the lip 5, so as to allow the free passage of the shaft 1 during assembly of the seal, while avoiding the need for excessive deformations of the resilient lip 5 caused by eccentricity or radial displacement of the shaft during assembly of the seal. Therefore if a fluted or splined part of the shaft shifts radially with respect to the seal during assembly of the latter, this part of the shaft will touch the flange part 7 of the rigid cover 3, causing a slight elastic deformation of a springy lip 5, which, thus, will not be seriously damaged by contact with the sharp parts of the fluted or splined part of the shaft.

On the other hand the rounded profile of the said flange 7 will avoid damage to the fluted or splined part of the shaft by the effect of reciprocal relative sliding between the flange and said part.

Figure 2 illustrates a variation of the embodiment of Figure 1 in which the rigid cover 3^1 is formed by two elements 3^1a, 3^1b of L-shaped profile, one of which, 3^1b, is provided with a protective annular flange 7^1 as shown in Figure 1. In this seal the resilient lip 5 is supported by an outer cylindrical collar 8 of the same material as the lip 5, anchored inside one of the elements (3^1a) of the rigid cover 3^1.

Figure 3 illustrates another variation according to which the rigid cover 3^{11} is formed by an inner element $3^{11}a$ of L-shaped section, and an outer element $3^{11}b$ of U-shaped section, the latter element $3^{11}b$ having on its opposite sides two symmetrical folded flanges 7^{11} and 9 disposed axially outwardly of the opposite ends of the seal, so as to form a double protective support for the shaft.

WHAT WE CLAIM IS:—

1. A seal for a rotary shaft of the type comprising a rigid cover adapted to be force-fitted into a seat in a support surrounding a rotary shaft, an annular resilient lip mounted in the cover and adapted to make circumferential contact with the surface of the shaft, and an annular garter spring which presses the said lip against said shaft surface, in which the rigid cover is provided on at least one of its axial ends with a rigid annular flange having an inner diameter greater than the inner diameter of the said lip, so as to act as a support for the shaft in use of the seal in the event of eccentric or radial displacement of the shaft relative to its support, and for the purpose of avoiding excessive deformation of the lip during assembly of the seal, the annular flange having a rounded shape and being bent in a direction away from the lip.

2. A seal according to claim 1, in which the cover is provided with two flanges disposed symmetrically at the two axial ends of the cover and adapted to give a double support to the shaft during assembly of the seal.

3. A rotary shaft seal substantially as herein described with reference to and as shown in the accompanying drawings.

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1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

Fig. 1

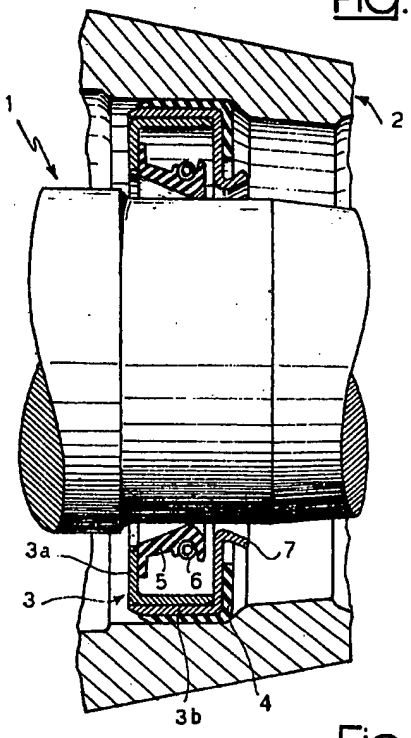

Fig. 2

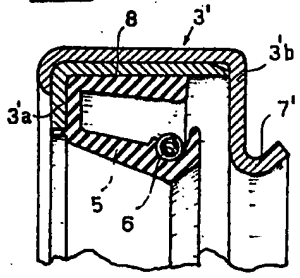

Fig. 3